





# **Cold Water Immersion**

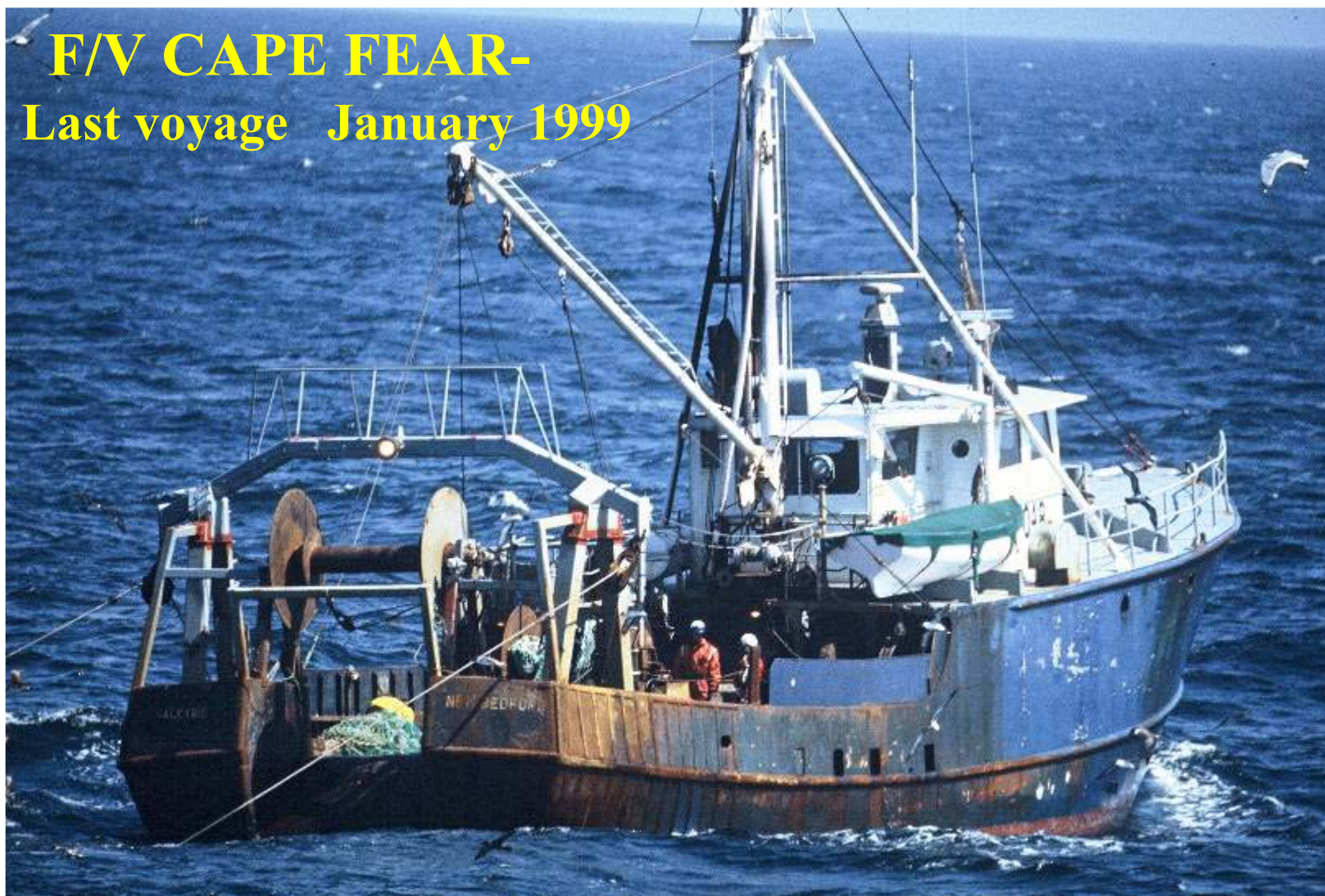
**Michael Jacobs, MD**

**SAFETY AT SEA SEMINAR, U.S. NAVAL ACADEMY 2005**

**THE CONCLUSION:**  
**SAILORS WHO DIE FROM**  
**COLD WATER IMMERSION**  
**DON'T DIE FROM**  
**HYPOTHERMIA,**  
**THEY DROWN, USUALLY IN THE**  
**FIRST FEW MINUTES, OR AT**  
**MOST, WITHIN 30 MINUTES**



**F/V CAPE FEAR-**  
**Last voyage January 1999**



“It is suspected that almost **one half** of the worldwide **140,000 deaths** in open water—especially those that occur during **sudden immersion in cold water** occur not from hypothermia, but from the **physiological responses** that occur within the first minutes of immersion”

CAN YOU SWIM??

ARE YOU A REALLY  
GOOD SWIMMER?

Does it make a difference?



# Larry Klein Lost

The tragedy, as related on CompuServe's Sailing Forum, is a reminder that even the most famous sailors make mistakes

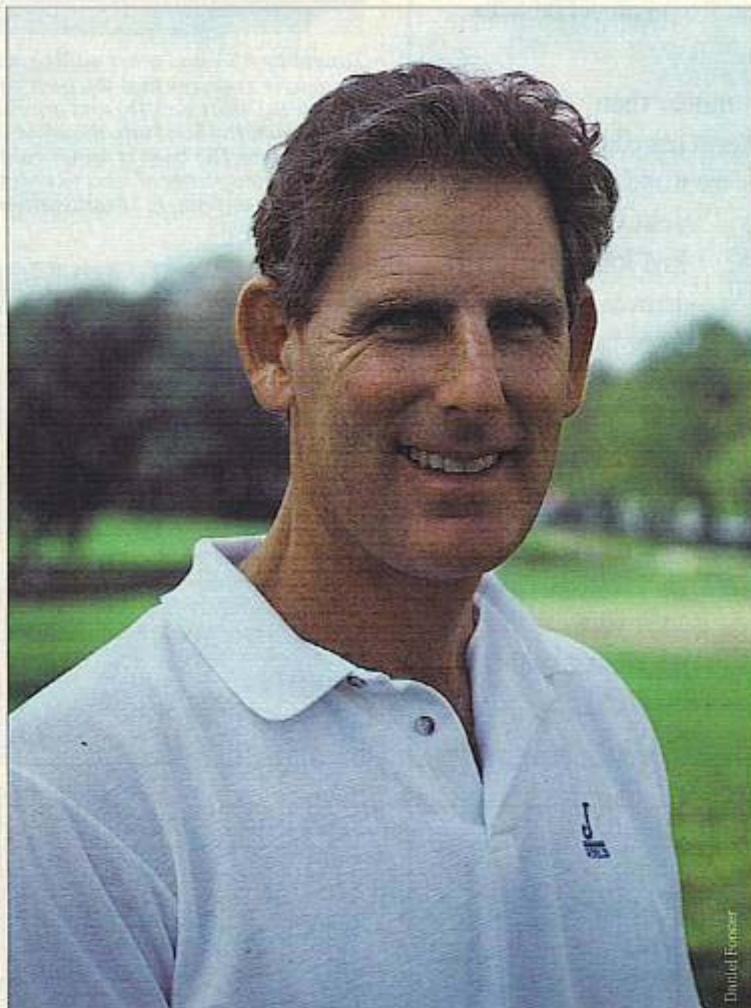
**O**n September 17, 1994, world champion sailor Larry Klein of San Diego drowned in San Francisco Bay. Klein, who was a U.S. Yachtsman Of The Year and held numerous world championships, was skipping an experimental boat called Twin Flyer in the St. Francis Yacht Club "Big Boat" series. The next day, on September 18, the following exchange began on CompuServe's Sailing Forum. The sailors participating in this on-line discussion had different levels of experience. Their dialogue underscores how important it is that we use PFDs in heavy weather and that we learn man-overboard recovery techniques. This exchange, which has been slightly edited because of space constraints, teaches a valuable lesson: Most sailors are probably not prepared for the worst.

— The Editors

## 9/18/94 From Chuck Riley:



There were eight of us on-board sailing the last beat of the second race of the day. We were leading the second place boat in our class by eight min-



Larry Klein, a three-time world champion sailor and 1989 Rolex yachtsman of the year, drowned after the hiking rack broke off the experimen-

seemed like an eternity, the racing boat *X Dream* sailed by, saw our situation and immediately came dead in the water. It took several of their crew on deck to pull Larry up from the water and on deck. The crew of *X Dream* immediately began CPR and continued until the Coast Guard arrived. We rushed to the St. Francis Yacht Club where paramedics met us. They continued to work on Larry for some time and then rushed him to the hospital where he was pronounced dead.

We all had PFDs onboard, but no one was wearing them. Ron Young and I were the only ones *not* wearing seaboots. It is my observation that the boots were a tremendous problem for those wearing them. We have entertained numerous proposals including holding crew overboard (COB) drills as part of all races, making mandatory the wearing of personal flotation devices (PFDs) in all races, requiring PFDs be worn *if* seaboots are worn, etc. Though inflatable harness/PFDs are not U.S. Coast Guard approved, I feel they may provide the best solution. The challenge we have is to get them to be "cool" and a badge of professional crew, like helmets have become for biking.

I did not know Larry well, but knew of him from sailing small



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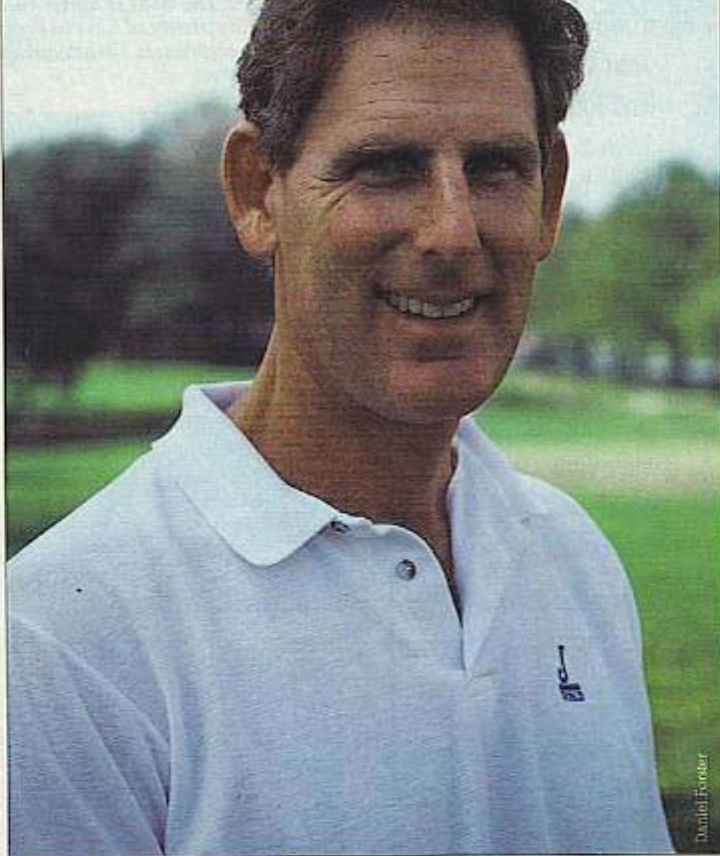
—The Editors

#### 9/18/94 From Chuck Riley:



There were eight of us on-board sailing the last beat of the second race of the day. We were leading the second place boat in our class by eight minutes. We had seven crew, including Larry, on the port "rack" (a shelf intended for hiking) beating into 18-knot winds and four-foot seas. Suddenly the rack failed and dropped seven of us in the water between Alcatraz and the city front. The one remaining crew on-board was having great difficulty tacking the boat to rescue us in the water. I saw that some of the crew near me, including Larry, were beginning to struggle to stay afloat.

After eight to 10 minutes in the water, Larry told me he didn't think he could make it any longer. I had a lifesaving hold on him with my left arm, trying to keep him afloat. Then another crew, Jorge Hegoiror of San Diego, told me he thought he couldn't make it either. I swam to Jorge, pulling Larry with me, and began to hold Jorge up with my other arm. I could then feel Larry's body go lifeless. After what



*Larry Klein, a three-time world champion sailor and 1989 Rolex yachtswoman of the year, drowned after the hiking rack broke off the experimental *Twin Flyer* (pictured on page 90). He is survived by his wife Leslie and two-year-old son Alexander.*

liked and respected in the yachting community. He will be missed.

#### 9/27/94 From Chuck Hawley:

In what now seems like a terrible coincidence, I participated in a series of Crew Overboard trials on San Francisco Bay a few days after Larry Klein drowned. We tested three distinct maneuvers: the Quickstop, the Figure Eight and the Fast Return, which is a modified and tighter version of the Figure Eight. We also tried various products to assist in reboarding: the Lifesling, stern boarding ladders, lengths of line draped over the stern (the Ele-



pull Larry up from the water and on deck. The crew of *X Dream* immediately began CPR and continued until the Coast Guard arrived. We rushed to the St. Francis Yacht Club where paramedics met us. They continued to work on Larry for some time and then rushed him to the hospital where he was pronounced dead.

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I did not know Larry well, but knew of him from sailing small boats in the Great Lakes many years ago. I do know he was well



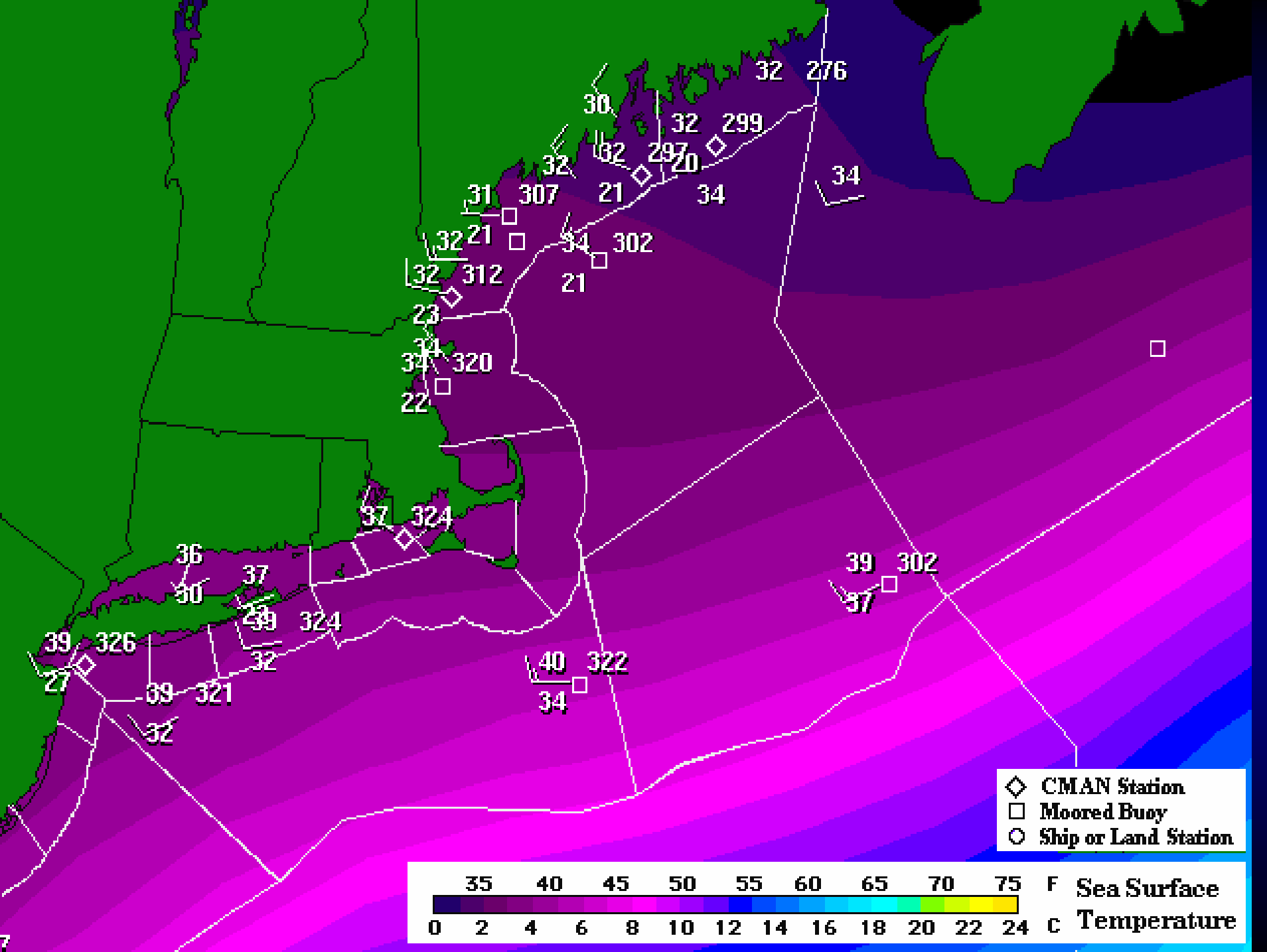
Half of the open water immersion deaths in UK occur within 10 feet of safety. Two thirds of those who die are considered good swimmers.

Statistics are indicative of some incapacitating response that is rapid in onset and prevents individuals from swimming 10 feet to save their lives.

**THE COLD SHOCK  
RESPONSE - ACCOUNTS  
FOR THE MAJORITY OF  
DROWNING DEATHS  
FOLLOWING ACCIDENTAL  
IMMERSION IN OPEN  
WATER BELOW 60° F.**

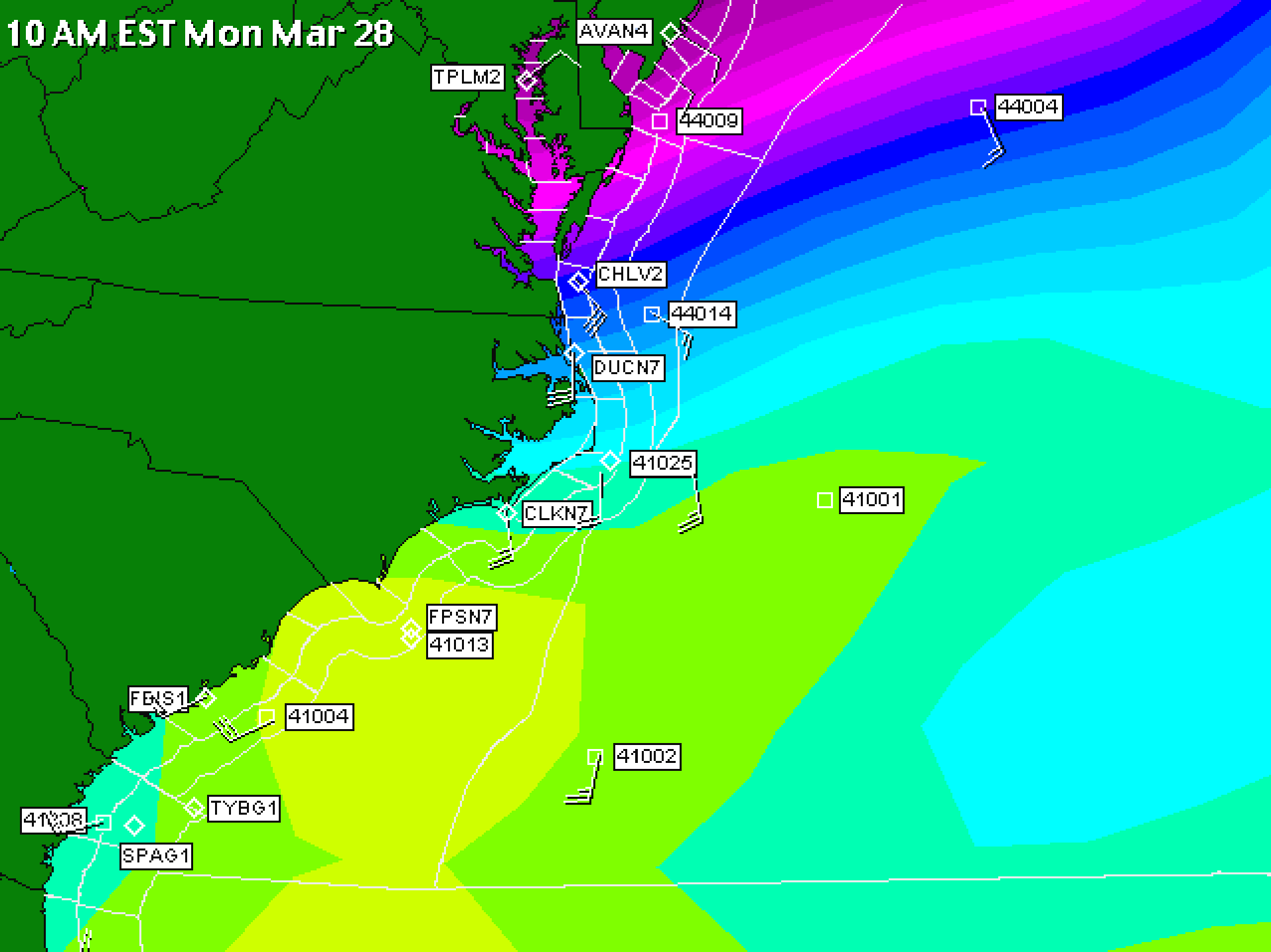








10 AM EST Mon Mar 28



# FOUR RESPONSES TO COLD WATER IMMERSION

1. **INITIAL** RESPONSE (0 -3 minutes)
2. **SHORT** TERM RESPONSE ( 3 -30)
3. **LONG** TERM RESPONSE ( >30)
4. **POSTIMMERSION** RESPONSE

Each response is caused by **cooling**  
**different parts of the body.**



# Cold Water Immersion-Initial Response

## THE COLD SHOCK RESPONSE

Sudden cooling of the **SKIN** → series of **reflexes** involving heart, blood pressure, and breathing which **peak** in **30 sec.**, last **3min.**, and increase the risk of **DROWNING**.

# Cold Shock Response-Reflexes

- Immediate “**gasp**” reflex—▶ inhaled water —▶ **DROWNING**
- ↑↑↑ **HR, BP, Adrenaline** —▶ risk **heart attack** —▶ **DROWNING**
- ↑↑↑ Rate and volume of **breathing** increases **5X**



# Cold Shock Response

**-Over breathing** —▶ **confusion & loss of consciousness** —▶ **DROWNING**

**-Rapid Breathing** —▶ **asynchrony** of swim stroke and breathing —▶ **aspiration and DROWNING**

**-Breath holding time** <10 sec.

—▶ **entrapment and DROWNING**

# **MODIFY THE COLD SHOCK RESPONSE-post immersion**

**\*\* (↑↑↑ Rate and volume of breathing)**

**MAKE A CONSCIOUS EFFORT TO  
BRING BREATHING UNDER  
CONTROL IN THE FIRST  
1 - 2 MINUTES**

**REMAIN STILL - DON'T PANIC**

# **PREVENTING COLD SHOCK RESPONSE-pre immersion**

## **HOW TO SAVE YOUR SKIN**

### **PROTECT IT !!!!!**

1. Avoid falling overboard- use safety harness
2. Avoid entering cold water when abandoning ship --life raft, helicopter ship to ship



# PREVENTING THE COLD SHOCK RESPONSE-pre immersion

3. If you must enter the water, wear clothing and PFD
4. Enter the water **VERY** slowly

# **Cold Water Immersion- Short Term Response**

## **Short Term Response- 3 to 30 minutes**

**- Muscles, Nerves and Joints affected:**

**Loss of strength, coordination,**

**dexterity, muscle performance,**

**loss of function  $\equiv$  PARALYSIS**

**Quickly lose ability to maintain  
airway freeboard; swimming is  
arduous and ineffective**

**Strong swimmers who survive the cold shock response **still** have only:**

**--50/50** chance of reaching shore

**--0.50** miles away in

**--50F** water

Again, the most common cause of death from accidental cold water immersion is from **drowning**, **not** immersion hypothermia!!





# **PROTECTIVE EQUIPMENT**

**1-WATERTIGHT CLOTHING-  
PROTECTS THE SKIN FROM  
COMING RAPIDLY INTO DIRECT  
CONTACT WITH COLD WATER**

**2-PFD, FLOAT JACKET – PROTECTS  
THE AIRWAY- INFLATE ORALLY  
OR MANUALLY BEFORE ENTERING  
THE WATER**







# **PROTECTIVE EQUIPMENT**

**3. BUOYANCY DEVICE- PROTECTS  
AIRWAY UNTIL BREATHING OK**

**“LITTER THE WATER”**

**4-INSULATION-PROTECTS MUSCLES,  
NERVES, & JOINTS IN THE LIMBS**

**5- LIFE RAFT – PROTECTS THE  
INTERNAL ORGANS -GET OUT OF  
THE WATER!!!!**

# **What the Coast Guard wears**

**< 60° F Anti-exposure Coverall**

inflatable head pillow, integral flotation; wet suit over uniform

**< 50° F MSD 900 Immersion Suit**

Thermal liner (PVC closed cell foam, watertight immersion module, outer shell with hood



Remember the Radio City  
Music Hall Rocketts



**YOU Survived Cold Shock Response and the  
Short Term Response, now what?**





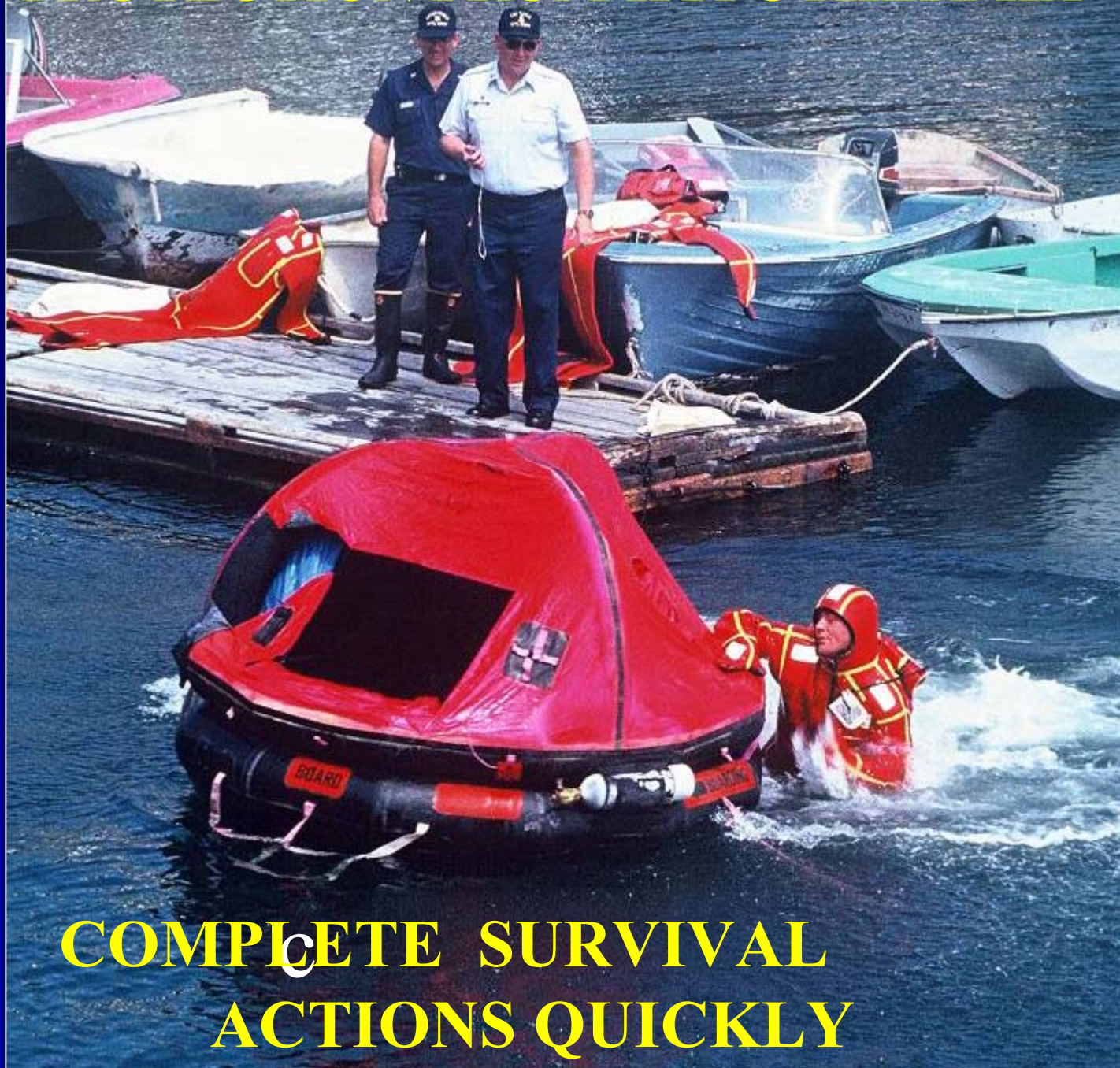
# Hypothermia –Long Term Response

**Rapid** drop in body temp from **30 minutes**  
**to several hours** following  
immersion in water **< 77 F**

**WHY??**

Water conducts heat away from the  
body **25X** greater than air

**PROTECTION FROM HYPOTHERMIA**



**COMPLETE SURVIVAL  
ACTIONS QUICKLY**



60°

60°





40°

60°







# HOW TO SURVIVE **1-10-1**

Dr. Gordon Giesbrecht, a noted hypothermia expert summarizes the timing of events after sudden unplanned immersion in frigid water:

- ONE minute** of gasping, when you need to control your breath.
- TEN minutes** of meaningful strength to pull yourself out of the water.
- ONE hour** before you lose consciousness.

**SHIT HAPPENS**



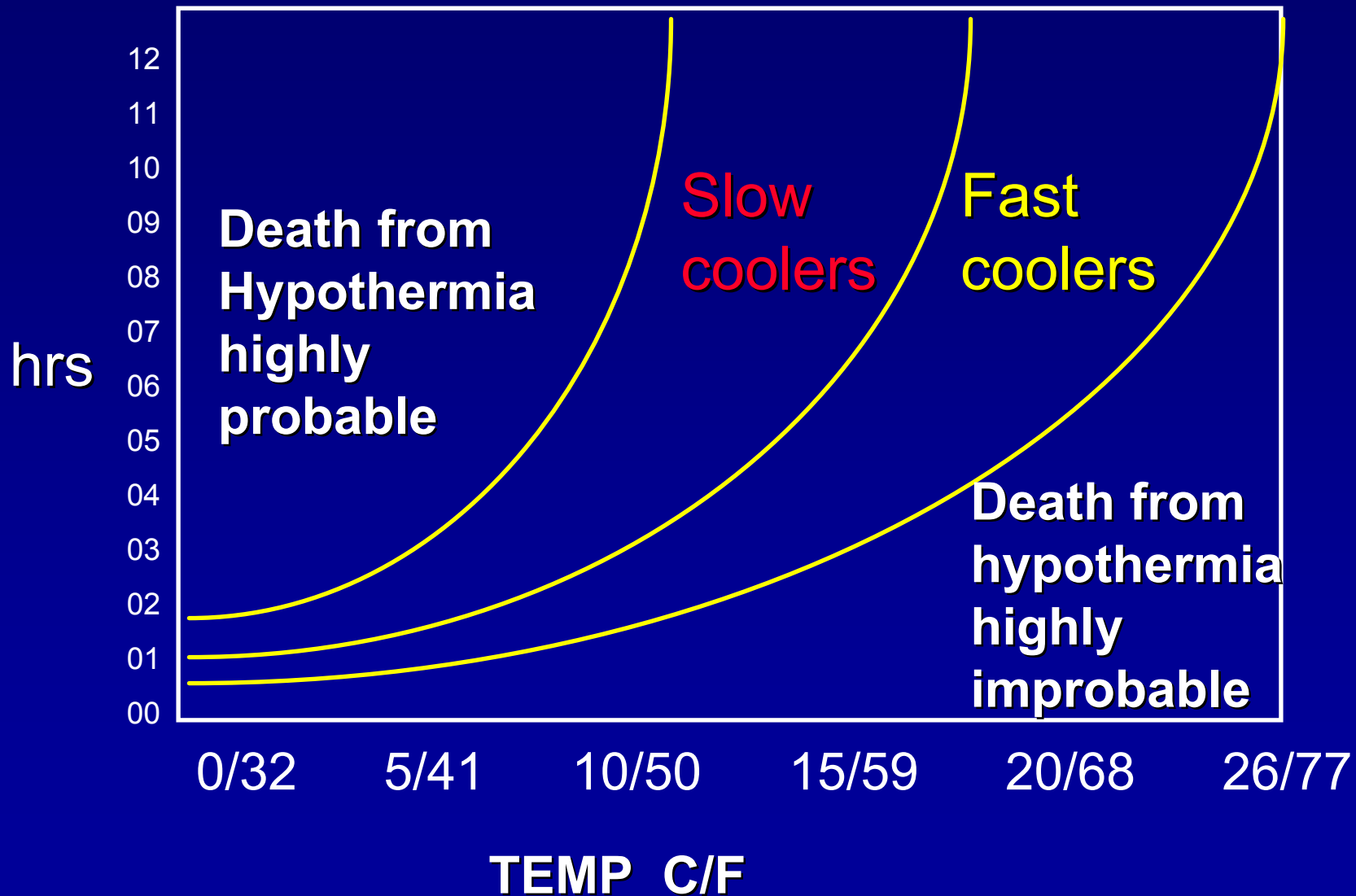


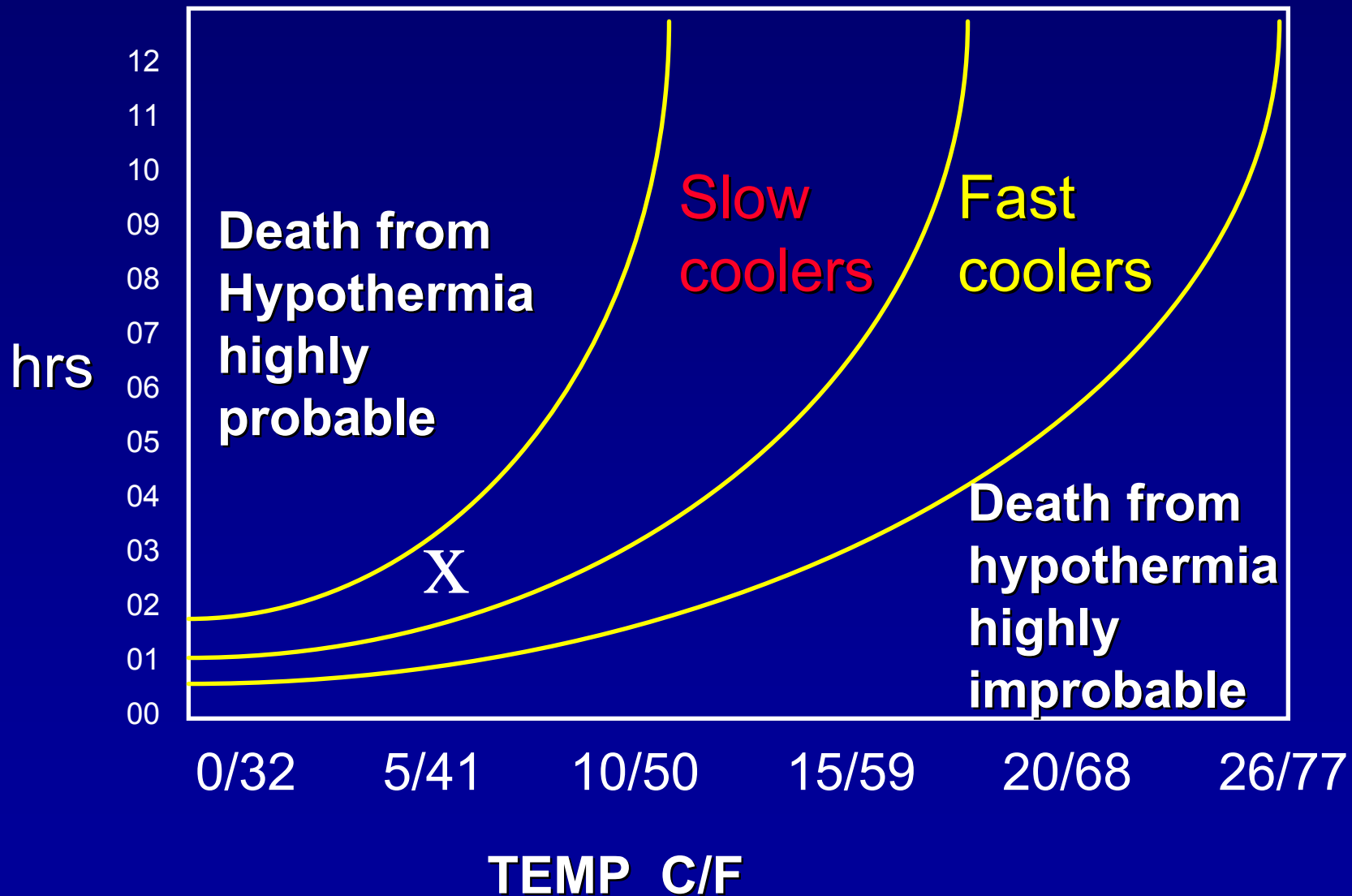






ARE YOU A SLOW  
COOLER  
OR ARE YOU A  
FAST COOLER?





way cool

slow cooler





# SLOW COOLING

If you fall overboard **with a PFD:**

Don't call for **help**, use **H.E.L.P. :**

**H**eat **E**scape **L**essening **P**osture

Any exercise in cold water increases cooling by 50%, and may decrease survival time by 50%



**Don't Undress:** “Don't lose your shirt, even if your in over your head”

**Clothing:**

**1: Traps Air--** Insulation & Buoyancy

**2: Traps Water---**Wet suit effect

**3: Reduces wind-chill** effect out of water

**BECOME A SLOW COOLER**

*The key is to **move slowly** to  
decrease heat loss (**slow cooler**)*

*Activity **flushes cold water**  
through protective garments*

*Activity **flushes warm blood**  
through the muscles of the  
extremities*



*Estimated Survival Times--* **With**  
**Vigorous Activity:**

**1 hr--32F ice water**

**2 hr--50F water**

**3-4hr--64F water**

*Floating , HELP, or slowly  
treading water can*

***DOUBLE these times !!***

Cowboys, not Sailors, die  
with their boots on!

Cover head, neck, hands &  
feet (boots on!)

**But:** Remove any clothing  
if forced to move quickly

## Hypothermia: Clues

Mild to Early Moderate ( Above 86F):

*Sustained uncontrolled shivering*

*Change in fine hand coordination*

*Loss of strength*

*Loss of balance*

*Changes in thoughts & judgment*

***FULLY CONSCIOUS***



# THE UMBLE FAMILY

◆ MUMBLE

◆ GRUMBLE

◆ BUMBLE

◆ STUMBLE

◆ TUMBLE

# Rx: Mild to Early Moderate Hypothermia

**Shelter, Dry skin**

**Dress in layers, Wrap with insulation**

**OK to give fluids, snacks (FUEL)**

**Rest For 30-60 minutes**

**EXTERNAL HEAT NOT  
NECESSARY-**

**LET VICTIM SHIVER**

## Hypothermia - Post Immersion Response

*Never* substitute a hot shower; the victim may suffer sudden cardiovascular collapse



# SHIVERING

- ONCE A PERSON STOPS SHIVERING, THE BODY HAS **LOST THE CAPACITY** TO ACTIVELY REWARM ITSELF

## Hypothermia Concepts

Mild	(95 F) Mental Status Chg.
Moderate	(90 F) Maximal Shivering
Early	(86 F) Shivering stops
Late	↓ Level consciousness
Severe	(82 F) Deep Coma

## Hypothermia: Clues

### Late Moderate to Severe Hypothermia (below 86F)

No subtle clues: *Signs obvious*

Decrease in level of consciousness

Progression to deep coma

**Not shivering**

May appear dead !

**Rx Late Moderate to Severe Hypothermia:**

**Shelter, Dry Skin**

**Dress in layers, Wrap in insulation**

**Handle gently horizontal position**

**ADD HEAT ( hot packs, cuddle)**

**EVACUATE!!!!!!**













